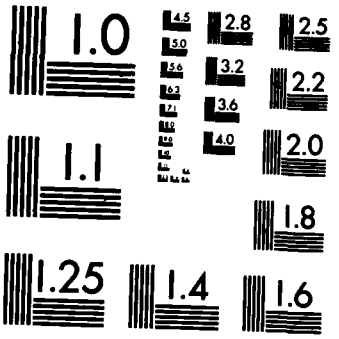
AD-A126 259 UNIT OF ISSUE(U) LOGISTICS MANAGEMENT INST WASHINGTON DC D V GLASS FEB 83 LMI-ML122 MDA903-81-C-0166 1/1

UNCLASSIFIED F/G 15/5 NL



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UNIT OF ISSUE

February 1983

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EXECUTIVE SUMMARY

Increasing the unit of issue for low-cost items in the DoD supply system will not effectively reduce the number of requisitions reaching the wholesale level. For an increased unit of issue to succeed, end users (i.e., mechanics, technicians, and small shops) would have to retain those items excess to their immediate need and use them to satisfy subsequent demands. Such a practice, in effect the creation of end user inventories, for the most part is prohibited by Military Department policy, and for good reasons. Such broader supply management concerns as preventing establishment of unaccountable inventories, monitoring adherence to shelf life designations, and assuring item identification, particularly for critical applications, are overriding. Because of such factors, the probability is very low that an item issued in excess of immediate requirement ultimately will be used.

There is a potential opportunity for decreasing the number of requisitions being processed at wholesale level. Presently, intermediate level supply activities do not include in their order quantity calculations the wholesale level cost of processing their requisitions. Doing so would result in a more truly economic order quantity calculation and would result in fewer requisitions against wholesale activities.

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1. INTRODUCTION

THE PROBLEM

There are more than 400,000 items with unit prices of $1 or less being managed through the Department of Defense (DoD) supply system. Each year, wholesale supply activities receive about 5 million requisitions for such items. The extended value (unit price times quantity ordered) of some 3 million of those requisitions is less than the cost to process the requisition. The phenomenon of spending more to process and issue a requisition than the requisitioned items are worth is a recurring concern of DoD supply managers.

Increasing the unit of issue[1] on selected low-cost items from "each" to some larger quantity has been suggested by the General Accounting Office (GAO), and others, as a solution to the problem. Proponents for increasing the unit of issue hypothesize that it would decrease the number of requisitions received at the wholesale level for low-cost items. Customers placing requisitions for items, each demand for a small quantity, would be issued those items in larger quantities. They would then retain the items excess to their immediate need and use them to meet future demands rather than submit another requisition. Fewer requisitions reaching the wholesale level would result in lower wholesale level costs.

SCOPE OF ANALYSIS

In 1979, the Defense Logistics Agency (DLA) did a study to determine whether there are any economies to be realized from increasing the unit of

[1]The unit of issue is the smallest quantity of an item that the supply system is permitted to issue a customer. All levels of the supply system must issue this quantity or a multiple of it. It also is the quantity to which the unit price is ascribed (DoD Instruction 4140.36).

issue for low-cost items from "each" to some larger quantity. We relied on that study as a base for this analysis; we find it well done but, as will be shown, question one of the key assumptions. Our assessment of increasing unit of issue also included review of Military Department policy prohibiting end-user inventories and the impact of that policy at the end-user level, i.e., upon those individuals engaged in the maintenance and repair of military equipment. During the course of our review, we found an apparent discrepancy in DoD policy covering economic order quantity (EOQ) requisitioning against wholesale stock which, if corrected, should result in a reduced number of requisitions to wholesale activities.

2. ANALYSIS

THE DLA STUDY

Method and Result

DLA selected a sample of 889 items from two Federal Supply Classes --5305 (Screws) and 5310 (Nuts and Washers). Each item in the sample had a unit of issue "each"; it cost less than $1; it was a stocked item; and it had a demand frequency of 6 or more per year.

DLA used an estimated cost of $6.09 for preparing, issuing, and processing each requisition. This cost is the sum of the customer cost to prepare a requisition ($1.27), the defense supply center cost to process a requisition ($.67), and the depot cost to issue the material ($4.15). The study also considered contractor packaging costs and the cost to the customer for the additional material. A key assumption in the DLA study was that customers would retain items excess to their immediate need and use them to meet subsequent demands rather than submit another requisition.

DLA developed the costs and savings associated with each item in the sample using a program which

> "...determined the number of requisitions which would be required to fill a customer's requirement if the U/I were 5/10/25/50/100/250/1000. For instance, if a customer had submitted 5 requisitions for a total quantity of 8 with U/I 'each' (1), the most he could submit with U/I '5' would be 2 requisitions. This would reduce requisitions by 3 but would force the customer to buy an additional two units."

The additional material and the packaging costs were summed for each item. This total was then compared with the savings resulting from the reduced number of requisitions, and the net savings computed. The alternative unit of

issue with the greatest net savings was taken as the "optimal" unit of issue for that item.

DLA found that increasing the unit of issue for 13 percent (114) of the items in the sample would generate gross annual savings of $6,279. The remaining items did not have sufficient repetitive demands to make a change worthwhile. The one-time cost of making the changes to cover the 114 items was not estimated; however, DLA reported the cost would be substantial. DLA concluded that: "Therefore, results must be carefully weighed and issue savings believable before investing in a vast program to change U/Is."

Evaluation

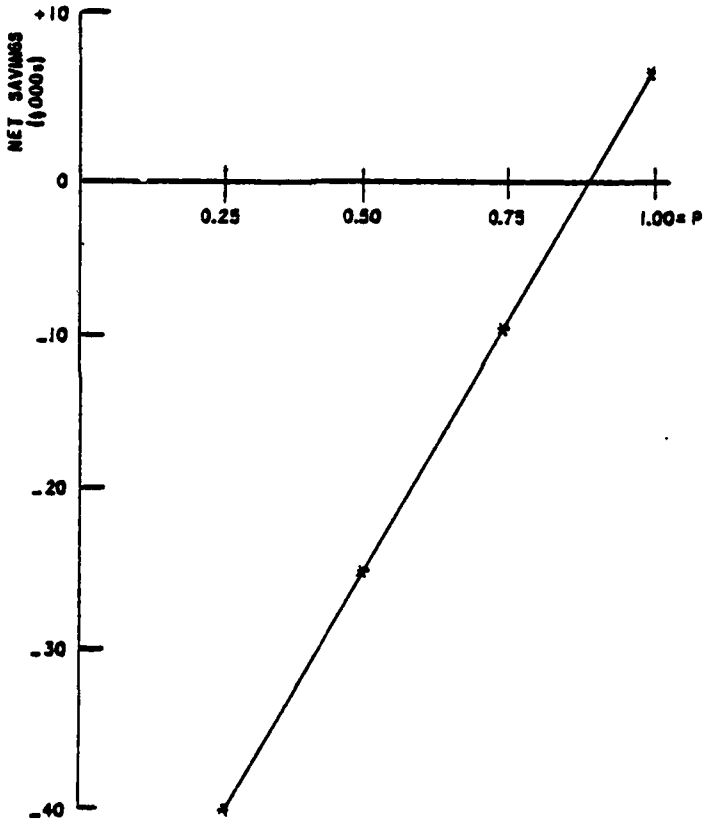
A decision-analysis approach to the problem shows that the occurrence of savings is completely dependent upon DLA's assumption that items issued in excess of immediate need would be used subsequently. Such use requires not only the retention of the excess from each requisition but also the identification and retrieval of the item(s) when needed.

Let us call P the probability that a subsequent requisition can be circumvented by using stock issued in excess on a prior requisition. The assumption of the DLA study was the P = 1.0 until the excess is exhausted.

The number of requisitions that would not be sent to the wholesale level as a result of changing the unit of issue is P x n, where n is the expected number of requisitions that would not be sent if P were equal to 1.0. (This is true given either independence or complete dependence for each subsequent requisition from a customer.) The difference between n and P x n can be used to calculate the additional cost of decreasing values of P. The results of the DLA study can thus be tested for sensitivity to changing values for P. DLA estimated that savings of $6,279 would result if the unit of issue was

increased for 114 items, assuming a P of 1.00. If P is not 1.00, but something less, such as 0.75, 0.50, or 0.25, then the net savings change to an additional cost of $9,027, $24,206, and $39,440, respectively. Figure 1 shows these results by displaying savings as a function of P. Savings from increasing the unit of issue are very sensitive to changing values for P, and unless P exceeds 0.90, additional costs rather than savings result.

FIGURE 1. NET SAVINGS AS A FUNCTION OF P



PROBABLE OUTCOME OF INCREASING UNIT OF ISSUE

Given the sensitivity of the economic analysis to P, we examined the practices of end-users in an attempt to estimate a reasonable P value.

If an end-user has a requirement for an item not stocked at base (intermediate), base supply orders it from a wholesale activity. If the wholesale activity should issue a larger quantity than needed by the requisitioner, what happens to the excess? Base supply is not authorized to take up the excess, i.e., open a bin and establish accountability. Instead, base supply would pass the total quantity issued to the requisitioning end-user. But the Military Departments prohibit many end-users from retaining items excess to their immediate need.

The Departments aim to prevent the establishment of unaccountable inventories; they strive to maintain the integrity of their supply system for many reasons including, for example, to monitor the shelf life of some items and, for critical applications, to assure that the correct stock number items are being used. Supply and maintenance managers recognize the high probability of items being damaged imperceptibly by being kept in tool boxes, on work benches, or in bench drawers by end-users.

In the Air Force, the critical application consideration prohibits flight line mechanics from retaining <u>any</u> excess items. In the Army, excess items are required to be returned to the supply system through successive levels using a "no questions asked" procedure. Some Navy technicians maintain small stocks of noncritical excess items, despite official policy against the practice. However, our on-site reviews disclosed that only a small portion of those items are used; reasons include inadequate part number identification, high turnover rates among technicians, forgetting, etc. Our review also showed there is almost no chance that a demand arising from one end-user would be satisfied from excess items issued to another end-user at a base.

Determining precise values for P would require an extensive investigation. Based upon observations at field installations and subjective

probabilities given by military personnel with experience at both the intermediate and the end-user levels, we estimate P to be as shown in Table 1.

TABLE 1. ESTIMATES OF P

	Army	Air Force	Navy
P =	0.1-0.3	0.1-0.25	0.1-0.5

Comparing the values in Table 1 with the levels needed to achieve savings (see Figure 1), it is clear that the probable effect of increasing the unit of issue for the 114 items would be increased costs rather than savings.

ECONOMIC ORDER QUANTITIES AT INTERMEDIATE LEVEL

DoD Instruction 4140.45 provides an economic order quantity (EOQ) calculation for use at intermediate level that does not include the wholesale cost to process and fill a requisition.

While the calculation may be economic for the intermediate level, it does not produce a system-wide EOQ calculation. Wholesale costs to process and fill are not included. Including them would increase the quantity per replenishment requisition submitted by intermediate level, and thus decrease the total number of requisitions received at depot.

OTHER SOMETIMES PROPOSED SOLUTIONS

During the course of our review, other approaches to lessening the number of low extended-value requisitions to the wholesale level were sometimes offered. We looked into three in particular and found them to have no merit.

Two Units of Issue

This proposal would have the DoD establish two units of issue for each low-cost item: one for use by the intermediate level in requisitioning

from the wholesale level, and the other for use by the end-user in requisitioning from the intermediate level. It is thought that by creating two units of issue, the end-user would receive exactly the quantity ordered and that requisitions for less than the unit pack, or whatever quantity is chosen for the larger unit of issue, would not be submitted to the wholesale level It is postulated that benefits from using two units of issue would occur at e wholesale level through the number of requisitions received.

However, the proposal would have benefits only if the items in question were authorized to be stocked at intermediate level. If they were stocked at intermediate, then intermediate would be replenishing from wholesale under some form of EOQ. Thus, the argument for two units of issue becomes moot.

Actual Order Cost

This proposal would have the DoD charge each customer the actual cost of a requisition, including the material cost, the transportation cost, and the cost to process and fill the requisition at the wholesale level. It is thought that by charging customers the actual cost to fill requisitions, they may be discouraged from submitting unnecessary or repetitive requisitions for small quantities of items. It would also provide both intermediate activities and end-users with more accurate information on the cost of doing business.

Charging customers for the actual cost of requisitions may have little effect on ordering habits if the requisitioner is unaware of the requisition cost, which could well be the case for end-users. The solution may also discourage use of the central supply system; substituting local procurement, with its potential for substantially increased (hidden) costs, could result.

In practice, this approach likely would have little effect other than to transfer a portion of the cost of operating the supply system to the end-user activity. And it would be very costly to implement.

Minimum Order Costs/Quantities

Under this proposal, the DoD would establish minimum order costs or minimum order quantities for requisitions sent to the wholesale level. It is argued that establishing minimum order costs or quantities would increase the average number of items on each requisition received at the wholesale level and, possibly, decrease the number of requisitions received at the wholesale level. The requisition minimums would discourage requisitions for small quantities of items because of the increased cost of making them, or by making more stock available to the intermediate and end-user levels.

There are two possible cases to be considered in evaluating this proposal -- that of an end-user requisition and that of an intermediate activity replenishment requisition.

An end-user requisition for an item not stocked at the intermediate level causes the intermediate activity to either pass the entire order on to the requesting end-user or put some part of it in stock. If the entire order is passed to the end-user, then the end-user is in a situation similar to that for an increased unit of issue -- the end-user cannot usefully retain the excess items, and the number of requisitions sent to the wholesale level is not reduced. In order for some part of the order to be put into stock at the intermediate level, a bin would have to be opened and management systems at the intermediate level would have to be changed -- a costly process.

In the case of a replenishment requisition, using minimum order costs/quantities would either have no effect or would arbitrarily increase the

order size. Since order quantities for replenishment requisitions are based on EOQ calculations, any arbitrary increase in order quantities would be noneconomic.

3. CONCLUSIONS

Increasing the unit of issue would result in increased costs rather than savings unless the prohibition of end-user inventories was lifted and a system could be devised to enable end-users to maximize the use of items issued in excess. Given the multiplicity of factors governing the design of the military supply system, no way of doing that is apparent. Designers and managers of the DoD supply system must recognize that economic efficiency of some subprocesses must be sacrificed in order to attain the total system effectiveness required in large-scale materiel support of military operations.

The number of replenishment requisitions to wholesale level could be diminished by specification of a more realistic economic order quantity calculation. The calculation now specified in DoDI 4140.45 deserves critical review of its exclusion of wholesale level costs to process and fill a requisition from intermediate level.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A126 259	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) UNIT OF ISSUE		5. TYPE OF REPORT & PERIOD COVERED FINAL
		6. PERFORMING ORG. REPORT NUMBER LMI TASK ML122
7. AUTHOR(s) DAVID V. GLASS		8. CONTRACT OR GRANT NUMBER(s) MDA903-81-C-0166
9. PERFORMING ORGANIZATION NAME AND ADDRESS Logistics Management Institute 4701 Sangamore Road, P. O. Box 9489 Washington, D. C. 20016		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Assistant Secretary of Defense (Manpower, Reserve Affairs, and Logistics)		12. REPORT DATE February 1983
		13. NUMBER OF PAGES 16
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

"A" Approved for Public Release; Distribution Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Unit of Issue, Repetitive Requisitions, Economic Order Quantity, EOQ, Low-Cost Items, Minimum Order Cost, Minimum Order Quantity

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Each year, DoD wholesale supply activities receive approximately one million repetitive requisitions for low-cost items. The cost to process those requisitions frequently exceeds the value of the items issued. It has been proposed that the unit of issue for these items be increased from "each" to some larger quantity to reduce the number of repetitive requisitions. The underlying rationale of the proposal is to have end-users retain excess items from the increased unit of issue to meet subsequent demands.

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20. ABSTRACT (Cont'd)

We found this desired outcome unlikely because the entire increased unit of issue would have to be passed to end-users who are usually unable or not permitted to retain items excess to immediate need. Our analysis shows that increasing the unit of issue would result in increased costs to the DoD rather than savings.

For items stocked at intermediate levels, changing the economic order quantity calculation specified in DoDI 4140.45 to include wholesale level requisition processing costs offers a partial solution to the problem of repetitive requisitions.


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